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**National Energy Board**

# ***Electric Power: A Compendium of Terms***

*This information bulletin provides explanations of terms commonly encountered in the regulation of the electrical utility industry.*

**Information Bulletin 8**

**May 1985**



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# NUCLEAR POWER A CHANGING SCENE

The Government of Canada has announced a new policy regarding nuclear power. This policy is designed to ensure that nuclear power is used in a safe and secure manner. The policy also states that nuclear power should be used in a way that is consistent with the interests of the Canadian people. The policy is a result of a long and careful process of consultation with the public and the nuclear industry. The policy is designed to ensure that nuclear power is used in a way that is safe and secure, and that it is used in a way that is consistent with the interests of the Canadian people. The policy is a result of a long and careful process of consultation with the public and the nuclear industry.

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## **ELECTRIC POWER: A COMPENDIUM OF TERMS**

This information bulletin takes the form of a glossary, providing non-technical explanations of various terms and expressions that may be encountered in regulatory proceedings on electrical matters before the National Energy Board.

These explanations are intended to assist the general reader without specialized knowledge of electrical engineering to understand technical terms in the field of electric power. The terms listed are those used in the Board's proceedings, and especially in its Reasons for Decision.

The Institute of Electrical and Electronics Engineers and other organizations publish dictionaries of technical definitions. Our expressions, being deliberately simplified and stated as far as possible in lay language, are intended to be explanations rather than definitions.

### **Electricity: A simplified explanation**

Electricity is a manufactured form of energy, as opposed to naturally occurring energy resources such as coal, oil or natural gas. On a large scale, electricity is produced by rotating machines (generators) which operate on the principle that an electric current is generated whenever a conductor moves through a magnetic field.

Large generators are driven by turbines, which may be hydraulic, steam or gas. Hydraulic turbines or waterwheels are rotated by the force of falling water. Steam turbines are driven directly by high-pressure steam produced by burning a fuel such as coal or by the heat of a nuclear reactor. Gas turbines are driven directly by the hot gases produced by combustion. On a smaller scale, generators may be driven by diesel or other types of engine, or even by devices such as windmills.

Electricity passing along a wire is termed an electric current. It consists of a high-speed stream of extremely minute subatomic particles known as electrons.

The flow of an electric current in a wire may be likened to the flow of water in a

pipe. The current (measured in amperes) is equivalent to the volume of water flowing per second. The voltage (measured in volts) is equivalent to the pressure forcing the water along the pipe.

In direct current, as produced by a battery, the current flows continuously in the same direction. In alternating current, as supplied by power systems, the current flows alternately in one direction and then in the opposite direction, reversing many times a second.

Alternating current is used universally because its particular characteristics enable it to be transmitted and distributed economically over wide areas. Its main advantage is that by the use of devices known as transformers its voltage can readily be raised or lowered.

### **Energy and Power**

To understand electrical matters, it is essential to grasp the distinction between energy and power.

**Energy** is defined by physicists as the capacity for doing work. Although the international unit of energy is the joule, electric energy is measured commercially in kilowatt hours. Residential meters record a household's consumption of electric energy in kilowatt hours over a period of time.

**Power** is the rate of doing work. In other words, it is the rate of delivery of energy. The international unit of power is the watt or the kilowatt (1000 watts).

Electricity produced at generating stations is "stepped up" in transformers to voltages suitable for long-distance transmission to the load centres. After passing through transmission lines and switching stations, it is "stepped down" by other transformers at substations to voltages suitable for local distribution. Finally, near the point of use, small transformers known as distribution transformers step the voltage down further to a level suitable for customer utilization.

### **Power Systems**

Virtually all the facilities used by an electrical utility to supply electricity to its customers are interconnected to form a power grid or "system". The system comprises generating stations, transformers, switching stations, transmission lines, substations, distribution lines, circuits to the customers' premises, and indeed all the different components required to provide electrical service to the consumer.

Today the electrical systems of most individual utilities are interconnected with neighbouring systems to form power pools. Through these interconnections, a system that needs extra power is helped by its neighbours. In addition, the load can be supplied from the most economical generation available, even if it belongs to another utility. To achieve such economy of operation, the individual utilities are constantly buying, selling, or exchanging electricity with each other. Often these transactions, known as inter-utility transfers, are negotiated on a day-to-day or even an hour-to-hour basis.

Most Canadian power systems are connected, not only to the systems in neighbouring provinces, but also to systems in the United States. For example, customers in Toronto are supplied from the same interconnected grid as those in New York City. Consumers in Vancouver are fed from the same network as those in San Francisco.

The National Energy Board regulates the construction and operation of international power lines under Part III of the National Energy Board Act and the export of electricity from Canada under Part VI. Electric power applications heard by the Board at public hearings are usually for a certificate of public convenience and necessity to authorize the construction of an international power line or for licences to authorize the export of electricity.





## Alphabetical Listing of Terms

**Acid Rain:** A general term describing precipitation (whether rain, sleet, hail, snow, or even dry deposition of acid particles) that has been acidified by the presence of atmospheric pollutants, primarily the oxides of sulphur and nitrogen.

**ACSR:** Aluminum conductor, steel reinforced. Aluminum strands are wound around a core of stranded steel. Basically the aluminum carries the electric current and the steel core provides the strength. Used extensively for overhead line conductors.

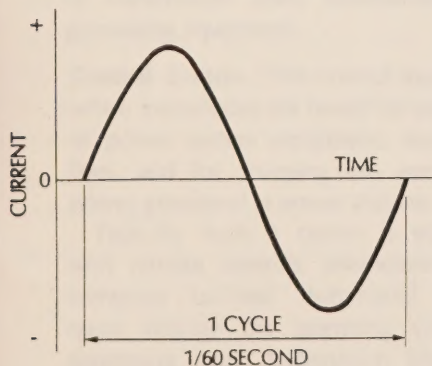
**Adjustment Transfer:** One of the five classes of inter-utility transfer defined in the National Energy Board Part VI Regulations. A transfer of electric power or energy made

- to adjust an energy account balance, or
- to compensate for electrical losses, or
- to compensate for services rendered, or
- to deliver output entitlements, or
- to provide upstream or downstream benefits.

**Adverse Water Conditions:** Water conditions that restrict the production of hydroelectric power, either through low streamflow or reduced head. See also: Dependable Streamflow

**Alternating Current (a-c):** A current that flows alternately in one direction and then in the reverse direction. See diagram. In North America the standard for alternating current is 60 complete cycles each second. Such electricity is said to have a frequency of 60 hertz.

Alternating current is used universally in power systems because it can be transmitted and distributed much more economically than direct current.



**Annual Storage:** Storage of water by a dam in which the filling and emptying cycle of the reservoir is one year, rather than several years.

**Assured System Capacity:** The dependable power generating capacity of system facilities available for serving system load after making provision for required reserve generation, including the effects of agreements with other systems.

**Asynchronous Tie:** A direct-current interconnection between two alternating-current systems. So called because the two alternating-current systems need not be in synchronism with each other.

**Average Energy:** The energy which would be generated by the hydro stations in a river system under average streamflow conditions. Normally stated in gigawatt hours.

**Average Streamflow:** The arithmetic average of all recorded flows in a river over a specified time period, usually on an annual basis. See also: Median Streamflow

**Banking of Energy:** The storage of energy by one electrical utility in the form of water in the reservoirs of another.

**Base Load:** The minimum continuous load over a given period of time. See also: Load

**Base Load Station:** A generating station which is normally operated to supply all or part of the base load of a system and which, consequently, operates essentially at full output whenever available. Base load generating units tend to be large units with low operating costs.

**Bipolar:** Having two poles, one positive and one negative.

**British Thermal Unit (Btu):** A unit of heat. The quantity of heat required to raise the temperature of one pound of water by one degree Fahrenheit.

**Bus:** A set of electrical conductors that serve as a common connection for two or more circuits. A bus may be in the form of rigid bars, either circular or rectangular in cross section, or in the form of cables.

**CANDU:** An acronym for Canada Deuterium Uranium. A family of nuclear fission reactors developed in Canada that

use natural uranium as the fuel and heavy water as the moderator.

**Capability:** The maximum load that a station or equipment is capable of carrying under specified conditions.

**Cfs:** Cubic feet per second. A measure of the flow of a river.

**Capacity:** In the electric power industry, this word has two meanings:

1. Power, that is, the rate of delivery of energy. For example, a utility might sell 50 megawatts of capacity, i.e. of power.
2. The maximum quantity of power that some piece of equipment is capable of carrying. For example, a generating unit might have a rated capacity of 50 megawatts.

**Capacity Factor:** For any equipment, the ratio of the average load during some time period to the rated capacity.

**Capacity Power:** Power and associated energy provided on a day-to-day basis to supplement the generating capacity of the receiving party at times of temporary deficiency. (A classification of power transfer used in several Canadian interconnection agreements.)

**Carrier Transfer:** One of five classes of inter-utility transfers defined in the National Energy Board Part VI Regulations. A carrier transfer is a transfer of electric power or energy by one utility over the circuits of another. The delivery may be to a third party or back to the originating utility.

**Cathodic Protection:** Reduction or prevention of corrosion of underground metallic structures by application of a direct current voltage. This voltage causes the underground metal to be at a negative voltage in relation to the surrounding soil, preventing corrosion.

**Certificate:** Authorization to construct and operate an international power line, issued under Part III of the National Energy Board Act, following a public hearing and the approval of the Governor in Council.

**Circuit:** Any conductor or set of conductors intended to carry electricity.





**Circuit Breaker:** A switching device to open or close an electric power circuit during either normal system operation or fault conditions.

**Circulating Flows:** See: Loop Flows.

**Cofferdam:** A temporary dam, usually made of log cribwork filled with rocks, built to hold back the water so that an area of the river bottom can be unwatered for construction purposes. After construction of the permanent works, the cofferdams are removed, usually by blasting.

**Cogeneration:** The combined production of electricity and useful heat. Cogeneration is often employed at industrial plants where the heat produced can be utilized in the manufacturing processes and for general space heating.

Cogeneration facilities use significantly less fuel to produce electricity and thermal energy than would be needed to make the two separately.

**Coincident:** Occurring at the same time (e.g., coincident peak loads).

Many loads on a power system reach their maximum values at different times; such demands are noncoincident. The total peak load on the system is therefore invariably less than the sum of the component peak demands. See also: Diversity

**Conductor:** Anything that conducts electricity. In the power industry, the term denotes cables, buses or wires. The word "wire" is seldom used.

Overhead line conductors are usually of ACSR or copper. See also: ACSR.

**Contingency Criteria:** Criteria, established for the design of a power system, which set out the performance of the system under conditions of forced outage of transmission lines, transformers and generating equipment.

**Control Centre:** The control room from which instructions are issued for switching of power system equipment, stations or lines, and for changing the amount of power generated in power stations.

Typically such a centre is equipped with remote controls, telemetering, and computer facilities. Automated system maps indicate the operating status of generating units, transmission lines and

main substation equipment. Metering devices show the loads being carried by units and lines, and the voltage levels at selected locations. Thus the system supervisor or "dispatcher" has a complete overall picture of the main features of the power system and can effectively coordinate its operations. See also: Dispatching

**Converter Station:** An installation for converting direct current into alternating current. (The term may also be used to describe a station for changing one frequency of alternating current into another, e.g. 25 hertz to 60 hertz.)

**Corona:** An electric discharge which is sometimes visible, resulting from a partial electric breakdown in a gas, as in the air surrounding a conductor at high potential. Corona on high-voltage transmission lines, especially during wet weather, may cause radio interference.

**Counterpoise:** A wire buried in the ground to reduce the ground resistance of transmission line towers. A low ground resistance is required for adequate protection of the transmission line against lightning.

**Current:** The flow of electricity in a conductor. Current is measured in amperes.

**Cycles per Second:** See: hertz.

**Decibel (dB):** The unit in which both audible noise and radio noise are measured.

**Decremental Generating Cost:** The cost saved by generating one less unit of electric energy below some previously determined base quantity. See also: Incremental Generating Cost

**Demand:** Same as peak demand.

**Demand Charge:** The component of a two-part price for electricity which is based on a customer's highest power demand reached in a specified period, usually a month, regardless of the quantity of energy used (e.g. \$2.00 per kilowatt per month). The other component of the two-part price is the energy charge.

**Dependable Capacity:** The load-carrying ability of a station or system under adverse conditions, as for example,

the capacity of a hydro station under defined low flow conditions.

**Dependable Energy:** The energy available from a hydroelectric generating station or a system under adverse water conditions. Adverse flow may be the minimum annual flow on record or may be based on other criteria of flow or rainfall.

**Dependable Streamflow:** The minimum river flow recorded over a long period of observation such as 40 years.

**Direct Current (d-c):** Current that flows continuously in the same direction (as opposed to alternating current). The current supplied from a battery is direct current.

**Direct-Current Transmission:** Transmission of electricity by direct current instead of the usual alternating current. In a direct current transmission line, one conductor is usually negatively charged relative to the ground and the other positively charged.

Direct current has certain advantages for long-distance point-to-point transmission and for interconnecting power systems that would otherwise be unstable if an attempt were made to tie them together by alternating current transmission.


At the beginning of 1985, there were four installations of high-voltage direct current in Canada, namely:

- Vancouver Island underwater transmission (B.C.)
- Nelson River overhead transmission (Manitoba)
- Eel River asynchronous tie (New Brunswick)
- Chateauguay asynchronous tie (Quebec).

**Dispatching:** The operating direction of a power system from a central "dispatcher's office" or control centre. Dispatching includes the allocation of load to individual generating stations or units, the scheduling of power transfers to and from interconnected utilities, and the switching of main transmission circuits and equipment.

Economic dispatch is the start-up, shutdown, and allocation of load to individual generating stations or units to effect the most economical production of energy for the system as a whole.





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**Diversity:** The phenomenon of different loads reaching their maximum levels at different times. The demands represented by such loads are said to be "noncoincident". Because of diversity, the total demand on a power system at any moment is less than the sum of all its individual loads.

**Economic Dispatch:** See: Dispatching

**Economy Energy:** Energy sold by one power system to another to effect a saving in the cost of generation when the receiving party has adequate capability to supply the loads on its own system.

For example, suppose that at a particular time the most economical generating unit that utility A had available to meet additional load on its system would cost 30 mills/kW.h to operate, but utility B had available a unit that would cost only 20 mills/kW.h. Then B could sell economy energy to A at some mutually agreed upon price between 20 and 30 mills. Both utilities would benefit from the transaction, A by getting energy more cheaply than it could generate it, and B by making a profit on the sale. See also: Split savings.

**Electric Energy:** Energy in the form of electricity, normally expressed in units of watt hours or decimal multiples of watt hours.

**Electric Field Strength:** The intensity of an electric field, usually expressed in kilovolts per metre.

**Electrical Utility:** An organization that, as its prime purpose, generates, transmits and/or distributes electric energy for sale.

**Electron:** An elementary particle containing the smallest negative electric charge. A flow of electrons is an electric current.

**Emission Limit:** The maximum level of substances or energy allowed by law to be released into the environment e.g., sulphur dioxide, noise, heat, radiation.

**Energy:** The capacity for doing work. See also: Electric Energy

**Energy Charge:** The component of a two-part price for electricity which is based on the amount of energy taken (e.g. 20 mills per kW.h). The other component of the price is the demand charge.

**Energy Transfer:** Electric energy transmitted through an inter-utility transfer point.

**Environmental Impact:** Any alteration to the environment caused by man and affecting human, animal, fish, and/or plant life. Pollution results in an adverse environmental impact because it is detrimental to human, animal and plant life.

**Equichange Transfer:** One of five classes of inter-utility transfers defined in the National Energy Board Part VI Regulations. An interchange of equal quantities of electric power or energy within a stated period.

**Excess Energy:** Same as surplus energy.

**Exemption Order:** An order authorizing the construction and operation of a relatively small international power line, made under section 49 of the National Energy Board Act. The Board may issue it without a hearing and without reference to the Governor in Council. Such an order is limited to power lines of operating voltage not exceeding 50 kV. Higher voltage lines require a certificate.

**Export Order:** An order authorizing the export of electricity from Canada, made under Section 7 of the NEB Part VI Regulations. Such an order may be issued by the Board without a public hearing and without reference to the Governor in Council.

The maximum export that may be authorized by order is 50 megawatts of power and 250 GW.h/year of energy for a maximum term of three years. Larger amounts or longer terms require a licence.

**Extra High Voltage (EHV):** Any transmission voltage higher than those commonly used. For many years, the utility industry has considered EHV to be 345 kV or higher, even though such voltages are becoming increasingly common.

**Feeder:** A circuit for feeding electricity into a service area or building.

**Firm Power:** Electric power intended to be available at all times during the period of the agreement for its sale.

**Forced Outage Rate:** The probability that a particular generating unit or other

system component will be unavailable for service because of breakdown.

**Frequency:** The number of cycles through which an alternating current passes in a second. The North American standard is 60 cycles per second, known as 60 hertz.

**Fuel Replacement Energy:** Energy sold by one utility to another to enable the purchaser to avoid burning fuel in its own thermal generating facilities. In effect, the purchased energy, often hydro, replaces fuel, hence its name.

Fuel replacement energy is often priced at a percentage of the fuel cost avoided by the purchasing utility (e.g., 75 percent).

**Generating Station:** A station comprising one or more generating units for the production of electricity.

The main types of generating station are hydroelectric, nuclear, and fossil-fuelled (coal, oil or natural gas).

**Generating Unit:** An electric generator, the prime mover that drives it, and all the associated equipment that must be operated together as a group to generate electricity.

**Generation Expansion Plan:** An electrical utility's plan of future additions to its generating capacity to supply the forecast increases in system load over a period of years.

**Generation Rejection:** Disconnecting selected generating units from a power system to preserve the continuing safe operation of the rest of the system. This action is sometimes taken if a large block of load has suddenly been cut off by some emergency, leaving generators feeding into the system without enough connected load to absorb their output. The units would otherwise overspeed, raising the frequency and voltage on the system to unacceptable levels.

Generation rejection is the opposite type of reaction to load rejection. See also: Load Rejection

**Generation Reserve:** See: Reserve Generating Capacity.

**Gigawatt hour (GW.h):** A unit of bulk energy. A million kilowatt hours. A billion watt hours.





**Grid:** A network of electric power lines and connections.

**Ground Electrode:** A conductor or group of conductors buried in the ground for the purpose of providing an electrical connection with the earth. Such a connection, with an appropriately low value of resistance, is often required for safety purposes, and is normally part of a converter station in a direct current transmission system.

**Head:** The difference in elevation between the water level immediately above a hydroelectric generating station and the water level immediately below it. (Measured in feet or metres.) The power output of the station is proportional to the head.

**Hearing Order:** An order issued by the Board to announce a hearing.

**Heat Rate:** A measure of generating station thermal efficiency, generally expressed as Btu per net kilowatt hour. It is computed by dividing the total heat (Btu) content of the fuel burned by the resulting net kilowatt hours generated. In metric units, heat rate is given as kilojoules per kilowatt hour.

**Heavy Water:** Water composed of isotopes of hydrogen of atomic weight greater than one, or of oxygen greater than 16, or of both; water composed of ordinary oxygen and the isotope of hydrogen of atomic weight 2; deuterium oxide, D<sub>2</sub>O. Used in CANDU nuclear reactors.

**Hertz (Hz):** The unit of frequency for alternating current. Formerly called cycles per second. The standard frequency for power supply in North America is 60 Hz. See also: Alternating current.

**High Tension:** High voltage. Any voltage in excess of 750 volts.

**Hydraulic Capacity:** The power output rating of a hydroelectric generating unit, or the sum of such ratings for all units in a station or group of stations.

**Hydroelectric Station:** An electric generating station in which the prime movers are hydraulic turbines. See also: Thermal Generating Station

**Impedance:** The total opposition offered by an electric circuit to the flow of an alternating current. Impedance is a combination of resistance and reactance.

**Impedance Diagram:** A single-line diagram of a power system showing the impedance of each circuit.

**Inadvertent Interchange:** In any specified period, the difference between the total net interchange of energy and the net scheduled or intentional interchange. The difference arises because of the difficulty of exactly controlling power flows between systems when there are multiple interconnections.

**Incremental Generating Cost:** The cost of generating one additional unit of electric energy above some previously determined base quantity. See also: Incremental Generating Cost.

**Installed Capacity:** The capacity measured at the output terminals of all the generating units in a station, without deducting station service requirements.

**Integrated Planning:** The planning of different power systems jointly in order to minimize total costs. Integrated planning is one of the characteristics of a true power pool.

**Interconnection Agreement:** An agreement made between two power utilities to govern the operation of interconnections between their systems. Typically such an agreement defines different classes of inter-utility transfers and specifies how they shall be priced between the two companies.

**Interconnected System:** A system consisting of two or more individual power systems connected together by tie lines.

**International Power Line:** The NEB Act defines an international power line as "facilities constructed or operated for the purpose of transmitting power from or to a place in Canada to or from a place outside Canada."

The Board normally considers an international power line as starting at the switching station in Canada nearest to the international border. For a distribution circuit, the international power line is normally considered as starting at the point

nearest the border where any Canadian load is tapped off.

**Interruptible Energy:** Energy made available under an agreement that permits curtailment or interruption of delivery at the option of the supplier.

**Inter-Utility Transfer:** A transfer of electric power or energy between two or more electrical utilities. The NEB Part VI Regulations define five classes of transfer, namely adjustment, carrier, exchange, sale and storage transfers.

**Inter-Utility Transfer Point:** A point at which electricity passes from the circuits of one electrical utility to the circuits of another.

**Ionization:** The process of adding one or more electrons to, or removing one or more electrons from, atoms, thereby creating ions or charged particles. High temperatures, electrical discharges, or nuclear radiations can cause ionization of the air.

**Isokeraunic Level (Lightning):** The average annual number of days having thunderstorms at any location. A measure of the frequency of lightning exposure.

**Isolated System:** An electric power system not interconnected with any other system. Isolated systems are usually of relatively small capacity.

**Joule:** The international unit of energy. The energy produced by a power of one watt flowing for one second. The joule is a very small unit: there are 3.6 million joules in a kilowatt hour.

**Kilovolt (kV):** 1000 volts.

**Kilowatt (kW):** The commercial unit of electric power. 1000 watts. A kilowatt can best be visualized as the total amount of power needed to light ten 100 watt light bulbs.

**Kilowatt hour (kW.h):** The commercial unit of electric energy. 1000 watt hours. A kilowatt hour can best be visualized as the amount of electricity consumed by ten 100 watt light bulbs burning for an hour. One kilowatt hour is equal to 3.6 million joules.

**Licence:** A licence to export electricity from Canada, issued under Part VI of the

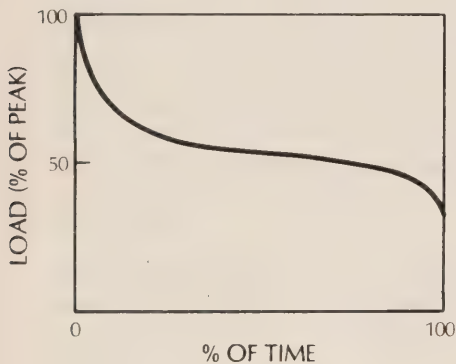




National Energy Board Act, following a public hearing. A licence is subject to the approval of the Governor in Council.

**Load:** The amount of electric power or energy consumed by a particular customer or group of customers.

**Load Duration Curve:** A curve for a specified period such as a day, a month, or a year, showing the amount of time during that period that the power load exceeded different values or different percentages of the maximum value.



**Load Factor:** The ratio of the average load during a designated period to the peak or maximum load in that same period. (Usually expressed in percent).

**Load Flow Diagram:** A schematic diagram of the main circuit components of a power system, showing the flows of electricity in each component under some stated condition. The flows may be actual values recorded at a particular time, but more usually are calculated by computer analysis.

**Load Rejection or Load Shedding:** Interrupting the supply of electricity to a selected region or group of customers as a means of preserving the continuing safe operation of the remainder of a power system. This action is sometimes taken in an emergency when the total system load exceeds the capacity of the generation available to supply it. See also: Generation Rejection.

**Loop Flow:** Unscheduled flows of electricity that occur whenever loop circuits are formed by multiple transmission lines. Such loop flows, by loading up some circuits, may reduce the total capacity available for the transmission of power.

**Losses:** Energy or power lost in circuits or equipment, mainly in the form of heat, when current flows through the circuits.

**Loss of Load Probability (LOLP):** The probability that a power system will be unable to supply all of its load through having insufficient generating capacity available to meet the total power demand. The traditional standard of acceptable LOLP is one day in not more than 10 years.

**Maximum Energy:** The energy that would be generated by a hydro station on a river system under maximum stream-flow conditions.

**Median Streamflow:** The median of all recorded flows in a river during a specified period. Median means the middle number of a series arranged in order of magnitude (as distinct from the average). The median flow is usually quoted rather than the average because the average flow may be distorted by occasional heavy floods.

**Megawatt (MW):** A unit of bulk power. 1000 kilowatts.

**Megawatt hour (MW.h):** A unit of bulk energy. 1000 kilowatt hours.

**Mil:** 1/1000 of an inch

**Mill:** 1/1000 of a dollar

**Multi-Annual Storage:** Storage in which the reservoir is able to even out fluctuations in water availability over a period in excess of one year. See also: Perennial Storage.

**Name Plate Rating:** The full-load continuous rating of a generator or other electrical equipment under the conditions designated by the manufacturer, as indicated on the name plate attached to the device.

**Nuclear Power:** Power generated at a station where the steam to drive the turbines is produced by an atomic process, rather than by burning a combustible fuel such as coal, oil, or gas.

**One-Line Diagram:** Same as: Single-Line Diagram.

**Order:** See: Hearing Order, Exemption Order, Export Order.

**Outage:** The state of any circuit component when it is not available to perform its intended function because of some event associated with that component. An outage may or may not cause an interruption of service to consumers, depending on the layout of the system.

**Out-of-Step Condition:** When one generating facility ceases to operate in synchronism with another.

**Ozone:** An allotropic form of oxygen with the chemical formula  $O_3$ , which takes the form of an unstable, pale-blue gas, with a penetrating odour. It is produced by an electrical discharge in air.

**Ozone Level:** The concentration of ozone in the air, usually measured in parts per million (ppm).

**Particulates:** Minute particles contained in the flue gases emitted from thermal generating stations.

**Peak Demand:** The maximum load consumed by a customer or a group of customers or a system in a stated period of time such as a month or a year. The value may be the maximum instantaneous load or more usually the average load over a designated short interval of time such as one hour. Normally stated in kilowatts or megawatts.

**Peaking Unit:** A generating unit intended to be operated intermittently to supply peak loads.

**Per Unit (p.u.):** Expressed in terms of a base of one. Same as the percentage system except unity is the base instead of 100. For example, 0.20 per unit is the same as 20 per cent. Used widely in power system calculations.

**Perennial Storage:** Storage in which the reservoir is able to even out fluctuations in water availability over a period in excess of one year. See also: Multi-Annual Storage.

**Phase Shifter:** A transformer designed to introduce an adjustable phase shift between its input and output voltages. A phase shifter may be used to control the flow of power in a tie line if system studies show that the flow will be excessive.

**Potential:** Another name for voltage.





**Power:** Power is the rate of delivery of energy and is measured in watts. (Electric energy is measured in watt hours.)

**Power Grid:** See: Grid.

**Power Pool:** A power pool is a grouping of two or more interconnected electric systems planned and operated to supply power in the most reliable and economical manner for their combined load requirements.

**Power System:** All the interconnected facilities of an electrical utility. A power system includes the generating stations, transformers, switching stations, transmission lines, substations, distribution lines, and circuits to the customers' premises. In short, a system consists of all the facilities required to provide electrical service to the customers.

**Power System Control Area:** The area controlled from the control centre of a utility or group of utilities. See also: Control Centre

**Primary Energy Source:** The source of primary energy from which electricity is generated. For example, falling water, uranium (by nuclear fission), coal, oil, natural gas, wind, or tidal energy.

**Prime Mover:** The turbine or engine that drives an electrical generator.

**Pumped Storage:** An arrangement in which, during off-peak hours, water is pumped from one reservoir to another at a higher location. During peak hours the water is allowed to return to the lower reservoir through hydroelectric turbines, thus generating power. Usually the turbines are reversible to act as pumps.

**Radio Interference (RI):** Unwanted disturbance in radio frequency bands, emanating from equipment or electrical circuits, which interferes with radio reception by causing radio noise.

**Radio Noise:** The noise in a radio receiver caused by radio interference.

**Rectifier Station:** An installation for converting alternating current into direct current.

**Rejection:** See: Load Rejection, Generation Rejection

**Renewable Resources:** Sources of energy which are inherently self-renewing, such as water power, solar energy, wind energy, tidal energy, and geothermal energy. Carbage and wastes burned as fuel are also considered renewable.

The use of these renewable resources reduces the need to consume non-renewable fossil fuels such as oil, natural gas, or coal.

**Reserve Generating Capacity:** The extra generating capacity required on any power system over and above the expected peak load. Such a reserve is required mainly for two reasons. First, in case of unexpected breakdown of generating equipment. Second, in case the actual peak load is higher than forecast. See also: Spinning Reserve.

**Resistance:** The opposition offered by any conducting material to the flow of a direct current of electricity. See also: Impedance

**Right-of-Way:** The strip of land on which a power line is located, and on which the power company has acquired the legal right to perform construction and maintenance, to trim vegetation, and sometimes to restrict construction by other parties. The width of the right-of-way varies with the characteristics of the line, e.g., the higher the voltage, the greater the width required.

**Run of the River Plant:** A hydroelectric generating station having negligible capability for storage of water, so that the plant has to run on the natural flow of the river as it comes. The output of the plant may therefore be subject to considerable variation.

**Sale Transfer:** One of five classes of inter-utility transfers defined in the National Energy Board Part VI Regulations. A transfer of electric power and energy under a contract of sale.

**Scheduled Maintenance:** Maintenance of equipment performed in accordance with a prearranged schedule.

The term is also used to designate the total capacity in megawatts of those generating units that are unavailable for use at any time because of the maintenance schedule.

**Scrubber:** A device for the removal, or washing out, of entrained liquid droplets or dust, or for the removal of an undesired gas component from process gas streams. The purpose is to reduce the quantity of contaminants emitted into the air from the stack of a thermal generating station.

**Seasonal Diversity:** The diversity between loads that reach their maximum values at different seasons of the year. For example, most Canadian power systems experience their annual peaks in the winter, whereas many U.S. systems have their annual peaks in the summer because of air-conditioning. Systems that differ in this way can effect economies in their operation by exchanging energy on a seasonal basis, transmitting it northwards in the winter and southwards in the summer. Such exchanges are termed "seasonal diversity exchanges". See also: Diversity

**Secondary Energy:** Electric energy that a utility sells as low-priced interruptible energy. This classification is not one of those defined in NEB regulations.

**Service Area:** The area in which a utility is required to, or has the right to, serve consumers.

**Short-term Power:** Power and associated energy which one utility purchases from another for the purpose of obtaining a supply of power intended to be available at all times during the period covered by the commitment. (One of the classifications of inter-utility transactions used in many Canadian interconnection agreements.)

**Signal-to-Noise Ratio (SNR):** The ratio at any location of the strength of a broadcast radio signal to the strength of radio interference noise. This ratio, usually expressed in decibels, is a measure of the quality of radio reception. A ratio below about 24 dB is considered intolerable, above 32 dB is entirely satisfactory.

**Single-Line Diagram:** A simplified diagram of a power system in which the three phases are represented by a single line.

**Single-Phase Circuit:** The simplest form of an alternating current circuit, carrying a single alternating voltage, and nor-





mally having two conductors. See also: Three-phase circuit.

**Social Benefits:** Benefits, whether tangible or intangible, resulting from a project.

Social benefits are distinguished from private benefits in that they include all the benefits of a project, whether or not they accrue to project sponsors. Thus, the social benefits of a project would include both benefits to project sponsors, suitably adjusted where the market prices of project outputs did not reflect their social value, and benefits of the project accruing to other Canadians.

**Social Costs:** Costs or damages, whether tangible or intangible, which a project causes to be imposed on a community, e.g., the environmental damages caused by air pollution from a coal-burning plant.

Social costs are distinguished from private costs in that they include the costs of a project incurred by all Canadians rather than only those incurred by the project sponsors. Social costs may differ from private costs in two ways: first, market prices for project inputs or outputs may not accurately reflect their social costs (e.g., the private wage bill may overstate the social opportunity cost of workers employed by a project if they would otherwise be unemployed); and second, some social costs of a project may not be borne by project sponsors (e.g., pollution costs).

**Spinning Reserve:** That portion of the reserve generating capacity which is actually in service, connected to the system, spinning, not generating full power, but ready to pick up load automatically at a moment's notice. See also: Reserve Generating Capacity.

**Split Savings:** A widely-used formula for the pricing of energy, especially economy energy sold by one utility to another, in which the total saving resulting from a sale is split equally between buyer and seller. See also: Economy Energy. In the example given there, the split-savings formula would result in a price of 25 mills/kW.h.

**Stability:** The ability of power systems to remain in synchronism.

**Step Voltage:** The voltage difference between two points on the earth's surface

separated by one pace (assumed to be one metre).

This voltage is significant when a short-circuit causes current to flow through the ground electrodes of power lines and substations. If the grounding system is not properly designed, the voltage can cause an electric shock.

**Storage:** The water held in a reservoir. Storage is used to even out the natural variations of flow in a river, so that the output of hydroelectric generation can be made as independent as possible of such natural variations.

Storage can be measured in any unit used to measure volume. In the imperial system several units are used, e.g., billions of cubic feet (bcf), millions of acre-feet, cfs-days, etc. In the metric system the usual unit is millions of cubic metres.

**Storage Transfer:** One of five classes of inter-utility transfers defined in the National Energy Board Part VI Regulations. An electric energy transfer "banked" for the time being in the form of water in reservoir space of another electrical utility, in the expectation that equivalent electric energy will be returned at a later time.

**Streamflow:** The quantity of water flowing past a given point in a river per unit of time. In the imperial system of units, streamflow is measured in cubic feet per second (cfs). In the metric system it is measured in cubic metres per second ( $m^3/s$ ).

**Substation:** A station at which the voltage of the bulk power system is stepped down to a level suitable for distribution, and at which the feeders at this lower voltage originate and may be switched on or off.

**Sulphur Dioxide:** A heavy, odourless, suffocating gas with the chemical formula  $SO_2$ . It occurs in the flue gases emitted from furnaces where fuel is burned, including thermal generating stations. Combining with water vapour in the atmosphere and in the presence of sunlight, it produces sulphuric acid and together with other acids leads to so-called acid rain.

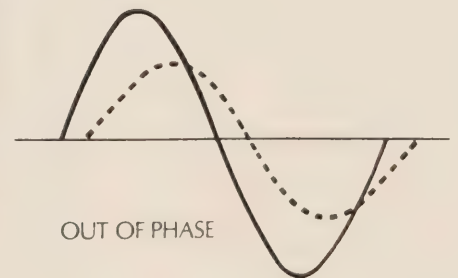
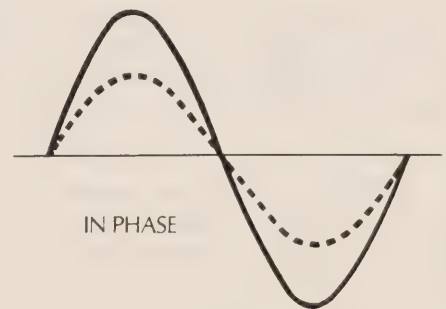
**Summer Peak:** The highest load on a power system during the summer. This peak is usually caused by air conditioning in hot weather.

**Surplus Energy:** Energy that is surplus to the needs of its owner including load and reserve.

On a power system, surplus energy or excess energy can be produced whenever the total generating capacity exceeds the total load. On systems with a high proportion of hydroelectric generation, surplus energy becomes available during periods of high streamflow such as during the spring runoff. Surplus energy is often sold on an interruptible basis.

Under Section 83 of the NEB Act, the Board, in considering any application for a licence to export oil, gas or electricity, is required to satisfy itself that the quantity to be exported does not exceed the surplus remaining after due allowance has been made for the reasonable foreseeable requirements for use in Canada.

**Synchronism:** The condition of alternating current generators being "in phase", that is, timed, so that their voltage waves reach the maximum and minimum values at exactly the same instant (see diagram). This is an essential condition in order for alternating current generators to operate in parallel on the same system.







**Synchronous Tie:** Any alternating current tie line. The word synchronous simply indicates that the generating units interconnected by the line must all be in synchronism.

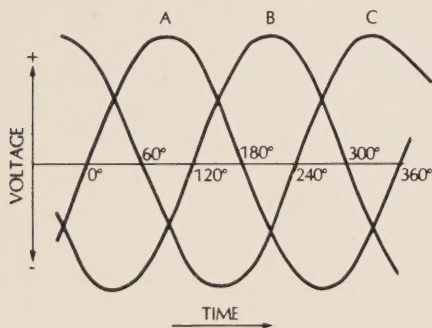
**Switching Station:** A station, usually outdoors, at which the transmission lines of a power system can be selectively connected or disconnected by means of switchgear.

**System:** See: Power System.

**Thermal Generating Station:** An electric generating station where the prime movers are driven by gasses or steam produced by burning fuels, such as coal, oil, gas, wood, etc., or by nuclear processes.

**Thermal Limit:** The limit to which an electric circuit element may be loaded without unduly damaging the element. The limit is imposed by temperature rise of the material.

**Three-Phase Circuit:** A circuit carrying three alternating voltages separated in time by one-third of a cycle, that is, 120 degrees. A three-phase circuit normally has three conductors; if it has a fourth, the fourth is a neutral return. The three phases are often designated A, B and C.



There are several reasons why all alternating current systems are three-phase. The most important is that three-phase results

in more economical transmission than single-phase or two-phase. Another is that three-phase electric motors are inherently self-starting, whereas single-phase motors require special starting windings.

Where single-phase circuits are used for distribution of electricity, they are simply tapped off a three-phase circuit.

**Throughput:** The amount of power transmitted through an electrical circuit. Normally stated in kilowatts or megawatts.

**Tidal Power:** Power produced by harnessing the natural rise and fall of the tide in an estuary or bay of the ocean.

**Touch Voltage:** The voltage difference between a metal structure and a person standing on the ground.

This voltage is significant when a short-circuit causes current to flow through the ground electrodes of power lines and substations. If the grounding system is not properly designed, the voltage can cause an electric shock.

**Transformer:** An electromagnetic device for raising or lowering the voltage of alternating current electricity.

**Transmission Line:** A line used for the transmission of electric power at high voltage. Transmission lines may be either overhead or underground. Overhead conductors may be supported on steel towers or concrete or wood-pole structures. Lines of voltage less than 115 kilovolts are normally considered to be subtransmission or distribution, rather than transmission.

**Turbine (Hydraulic):** A rotary type of prime mover in which mechanical energy is produced by the force of water, steam or gas directed against blades fastened to a rotating shaft.

**T.V. Interference:** Unwanted disturbance in T.V. frequency bands which interferes with reception.

**Ultra High Voltage (UHV):** Any voltage in excess of approximately 1000 kV.

**Voltage:** The electrical force or potential that causes a current to flow in a circuit (just as pressure causes water to flow in a pipe). Voltage is measured in volts or kilovolts (kV). 1 kV = 1000 volts.

In North America, the standard voltage for residential use is 115 volts, with 230 volts for heavy appliances such as ranges, dryers and hot water heaters.

Any voltage in excess of 750 volts is considered high voltage.

Voltages used for urban and rural distribution range from 4 kV to 25 kV or more. The most common transmission voltages are 115, 132, 230, 345, 500 and 735 kV. The higher the voltage, the more power a transmission line can carry.

**Watt:** The scientific unit of electric power. A rate of doing work of one joule per second. A typical light bulb is rated 25, 40, 60 or 100 watts, meaning that it requires that amount of power to light it. A horse power is 746 watts. See also: Kilowatt.

**Wheeling:** The transmission of power belonging to one utility through the circuits of another utility for delivery either to a third party or back to the originating system.

**Winter Peak:** The highest load on a power system during the six-month period October to March. The winter peak almost always occurs in December or January. Normally stated in kilowatts or megawatts.





**PREVIOUS  
INFORMATION BULLETINS**

Bulletin No.	Title	Release Date
1	Route Approval Procedures	September 1983
2	The Public Hearing Process	October 1983
3	Non - Hearing Procedures	November 1983
4	How to Intervene	January 1984
5	N.E.B. Publications	February 1984
6	The Board's Approach to the Regulation of Tolls and Tariffs under Part IV of the N.E.B. Act	March 1984
7	The N.E.B. Library	May 1984

